Project Status 1.11 Intermediate Tracker

Rachid Nouicer, for INTT Group

L2 Meeting, March 30th, 2017

Documents from Last 20 Days

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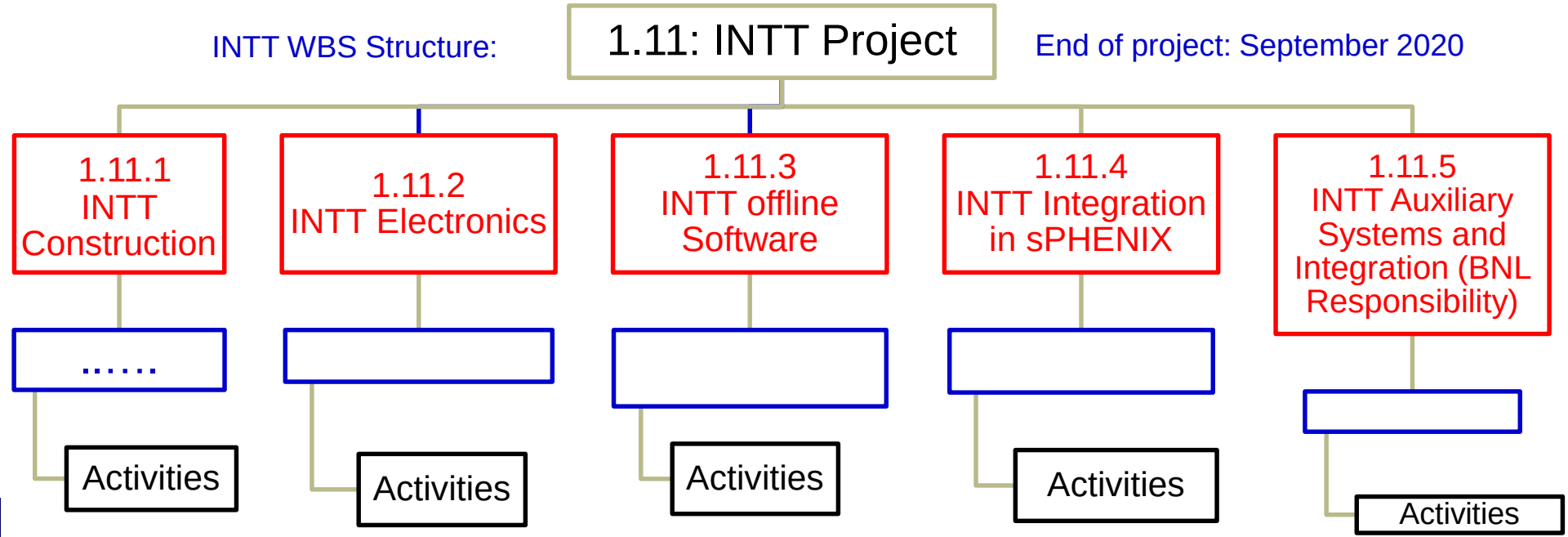
SPHENIX-doc-#	Title	Author(s)	Topic(s)	Last Updated
57-v1	Intermediate Tracker (INTT) sPHENIX	Rachid Nouicer	MS Project Files for CD1	13 Mar 2017

Yes, the INTT WBS was done and submitted on March 13th. The group implemented all the steps toward the INTT construction starting from prototyping up to completion, and integration. Even detector survey at the lab is included. Mainly, we decided to use WBS as a guide line for the INTT construction making sure that we don't forget any step.



INTT WBS

Example page 1 of WBS (See auxiliaries slides for full INTT WBS)

ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
1		**1**	**sPHENIX**	**995 days?**	**Tue 1/3/17**	**Wed 12/30/20**		
2		**1.12**	**INTT Project**	**995 days?**	**Tue 1/3/17**	**Wed 12/30/20**		
3		**1.12.1**	**INTT Construction**	**401 days**	**Mon 5/15/17**	**Fri 12/21/18**		
4		**1.12.1.1**	**Ladder Layer 0**	**325 days**	**Thu 8/31/17**	**Thu 12/20/18**		
5		1.12.1.1.1	Design Prototype 1 Module Support	5 days	Thu 8/31/17	Thu 9/7/17		6
6		1.12.1.1.2	Fabrication Porotype 1 Module Support	5 days	Fri 9/8/17	Thu 9/14/17	5	7
7		1.12.1.1.3	Silicon Module Prototype 1	20 days	Fri 9/15/17	Thu 10/12/17	6	8
8		1.12.1.1.4	Silicon Module Prototype 1 Testing	10 days	Fri 10/13/17	Thu 10/26/17	7	
9		1.12.1.1.5	Silicon Module Assembly Prototype 2 (PreProduction)	20 days	Wed 3/7/18	Tue 4/3/18		10
10		1.12.1.1.6	Silicon Module Prototype 2 Testing	10 days	Wed 4/4/18	Tue 4/17/18	9	11
11		1.12.1.1.7	Design Ladder Assembly Fixtures	10 days	Wed 4/18/18	Tue 5/1/18	10	12
12		1.12.1.1.8	Fabrication Assembly Fixtures	20 days	Wed 5/2/18	Wed 5/30/18	11	13
13		1.12.1.1.9	Ladder Prototype Assembly	20 days	Thu 5/31/18	Wed 6/27/18	12	14
14		1.12.1.1.10	Ladder Prototype Testing	20 days	Thu 6/28/18	Fri 7/27/18	13	15
15		1.12.1.1.11	Ladder Production	100 days	Mon 7/30/18	Thu 12/20/18	14	
16		**1.12.1.2**	**Ladder Layer 1,2 , 3**	**401 days**	**Mon 5/15/17**	**Fri 12/21/18**		
17		1.12.1.2.1	Design Prototype 1 Module Support	5 days	Mon 5/15/17	Fri 5/19/17		18
18		1.12.1.2.2	Fabrication Porotype 1 Module Support	5 days	Mon 5/22/17	Fri 5/26/17	17	19
19		1.12.1.2.3	Silicon Module Prototype 1	20 days	Tue 5/30/17	Mon 6/26/17	18	20
20		1.12.1.2.4	Silicon Module Prototype 1 Testing	10 days	Tue 6/27/17	Wed 7/12/17	19	
21		1.12.1.2.5	Silicon Module Assembly Prototype 2 (PreProduction)	20 days	Tue 11/21/17	Wed 12/20/17		22
22		1.12.1.2.6	Silicon Module Prototype 2 Testing	17 days	Thu 12/21/17	Thu 1/18/18	21	

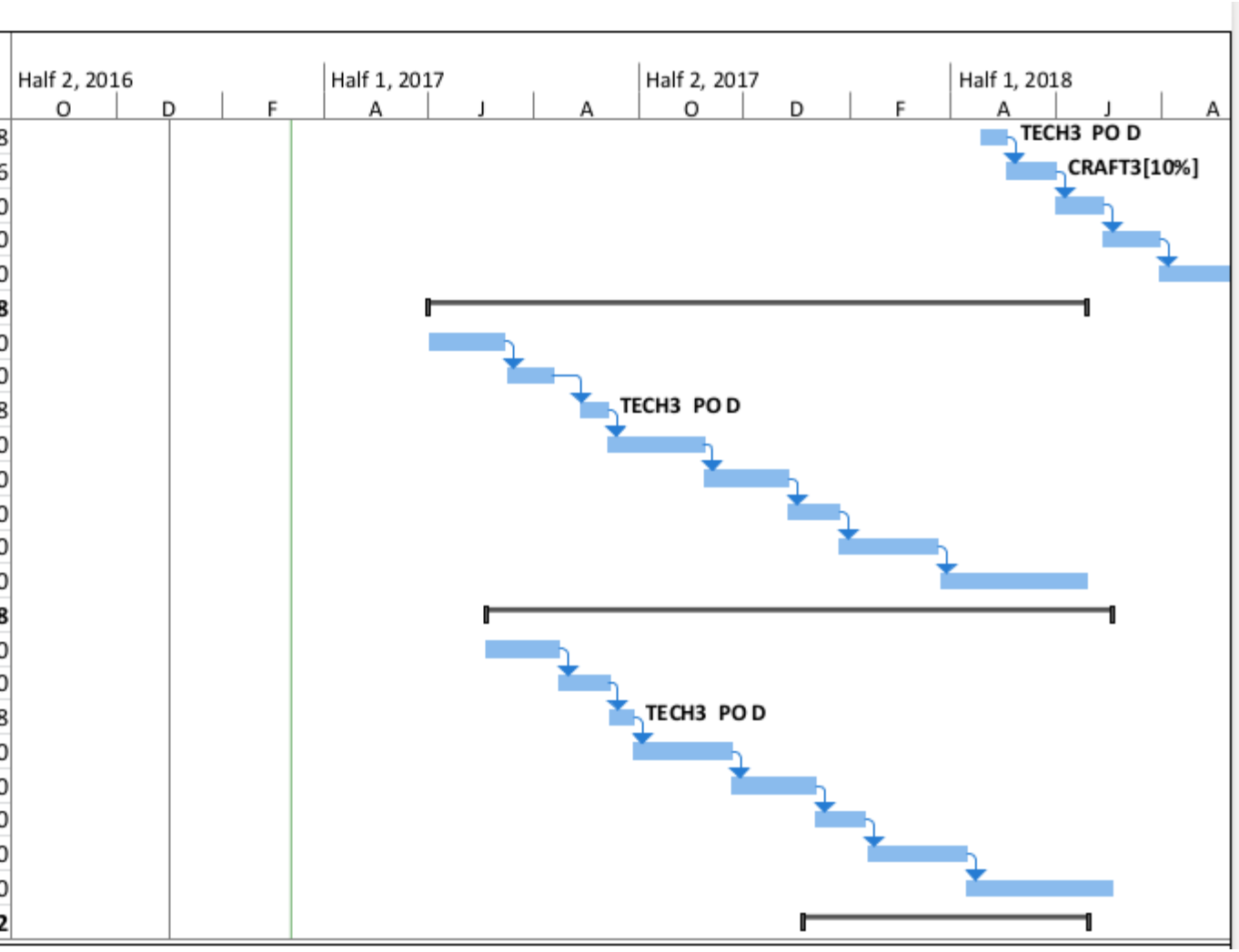
Auxiliaries Slide: Page 2

ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
23		1.12.1.2.7	Design Ladder Assembly Fixtures	10 days	Thu 4/19/18	Wed 5/2/18		24
24		1.12.1.2.8	Fabrication Ladder Assembly Fixtures	20 days	Thu 5/3/18	Thu 5/31/18	23	25
25		1.12.1.2.9	Ladder Assembly Prototype	20 days	Fri 6/1/18	Thu 6/28/18	24	26
26		1.12.1.2.10	Ladder Prototype Testing	20 days	Fri 6/29/18	Mon 7/30/18	25	27
27		1.12.1.2.11	Ladder Production	100 days	Tue 7/31/18	Fri 12/21/18	26	
28		**1.12.1.3**	**Stave Layer 0**	**261 days**	**Thu 6/1/17**	**Mon 6/18/18**		
29		1.12.1.3.1	Conceptual Design of the Stave	30 days	Thu 6/1/17	Fri 7/14/17		30
30		1.12.1.3.2	Thermal Mechanical Simulation	20 days	Mon 7/17/17	Fri 8/11/17	29	31
31		1.12.1.3.3	Design Stave Prototype 1	10 days	Tue 8/29/17	Tue 9/12/17	30	32
32		1.12.1.3.4	Procurement for Stave Prototype 1	40 days	Wed 9/13/17	Tue 11/7/17	31	33
33		1.12.1.3.5	Fabrication Stave Prototype 1	30 days	Wed 11/8/17	Tue 12/26/17	32	34
34		1.12.1.3.6	Testing of Stave Prototype 1	20 days	Wed 12/27/17	Thu 1/25/18	33	35
35		1.12.1.3.7	Procurement for Stave Production	40 days	Fri 1/26/18	Fri 3/23/18	34	36
36		1.12.1.3.8	Stave Production	60 days	Mon 3/26/18	Mon 6/18/18	35	
37		**1.12.1.4**	**Stave Layer 1,2,3**	**250 days**	**Wed 7/5/17**	**Tue 7/3/18**		
38		1.12.1.4.1	Conceptual Design of the Stave	30 days	Wed 7/5/17	Tue 8/15/17		39
39		1.12.1.4.2	Thermal Mechanical Simulation	20 days	Wed 8/16/17	Wed 9/13/17	38	40
40		1.12.1.4.3	Design Stave Prototype 1	10 days	Thu 9/14/17	Wed 9/27/17	39	41
41		1.12.1.4.4	Procurement for Stave Prototype 1	40 days	Thu 9/28/17	Thu 11/23/17	40	42
42		1.12.1.4.5	Fabrication Stave Prototype 1	30 days	Fri 11/24/17	Thu 1/11/18	41	43
43		1.12.1.4.6	Testing of Stave Prototype 1	20 days	Fri 1/12/18	Fri 2/9/18	42	44
44		1.12.1.4.7	Procurement for Stave Production	40 days	Mon 2/12/18	Mon 4/9/18	43	45
45		1.12.1.4.8	Stave Production	60 days	Tue 4/10/18	Tue 7/3/18	44	
46		**1.12.1.5**	**Barrel Mount**	**115 days**	**Fri 1/5/18**	**Tue 6/19/18**		

INTT WBS

Example page 1 of WBS (See auxiliaries slides for full INTT WBS)

Fixed Cost	Cost
¥0	¥6,488
¥300,000	¥301,816
¥0	¥0
¥0	¥0
¥6,000,000	¥6,000,000
¥0	**¥686,488**
¥0	¥0
¥0	¥0
¥0	¥6,488
¥240,000	¥240,000
¥0	¥0
¥0	¥0
¥440,000	¥440,000
¥0	¥0
¥0	**¥2,506,488**
¥0	¥0
¥0	¥0
¥0	¥6,488
¥300,000	¥300,000
¥0	¥0
¥0	¥0
¥2,200,000	¥2,200,000
¥0	¥0
¥0	**¥1,209,732**



Summary Obtained from the WBS

Cost for each year: fixed cost, labor cost, procurements…in Dollars

INTT Project Estimate - March 13, 2017 rev 1 (031517)

Description				Japanese Fiscal Year (APR- Mar)					
Resources	Task 3	Task 4	Task 5	2016	2017	2018	2019	2020	Grand Total
Task's Fixed Cost	INTT Construction	Ladder Layer 0		$ -	$ -	$ -	$ 33,000	$ -	$ 33,000
		Ladder Layer 1,2 , 3		$ -	$ -	$ -	$ 63,000	$ -	$ 63,000
		Stave Layer 0		$ -	$ -	$ 6,800	$ -	$ -	$ 6,800
		Stave Layer 1,2,3		$ -	$ -	$ 25,000	$ -	$ -	$ 25,000
		Barrel Mount		$ -	$ -	$ 12,000	$ -	$ -	$ 12,000
		INTT Space Frame		$ -	$ -	$ 10,000	$ -	$ -	$ 10,000
	INTT Construction Total			$ -	$ -	$ 53,800	$ 96,000	$ -	$ 149,800
	INTT Electronics	Silicon Sensor layer 0		$ -	$ -	$ 113,000	$ -	$ -	$ 113,000
		Silicon Sensor layer 1,2, 3	Procurement Prototype 1	$ 50,000	$ -	$ -	$ -	$ -	$ 50,000
			Procurement Prototype 2 (PreProduction)	$ -	$ 50,000	$ -	$ -	$ -	$ 50,000
			Procurement for Production	$ -	$ 315,000	$ -	$ -	$ -	$ 315,000
		Silicon Sensor layer 1,2, 3 Total		$ 50,000	$ 365,000	$ -	$ -	$ -	$ 415,000
		FPHX Chips		$ -	$ 83,600	$ -	$ -	$ -	$ 83,600
		HDI		$ 30,000	$ 465,840	$ -	$ -	$ -	$ 495,840
	INTT Electronics Total			$ 80,000	$ 1,027,440	$ -	$ -	$ -	$ 1,107,440
Task's Fixed Cost Total				$ 80,000	$ 1,081,240	$ 96,000	$ -	$ -	$ 1,257,240
TECH3 PO E	INTT Construction	INTT Assembly		$ -	$ -	$ 1,946	$ -	$ -	$ 1,946
	INTT Construction Total			$ -	$ -	$ 1,946	$ -	$ -	$ 1,946
TECH3 PO E Total				$ -	$ -	$ 1,946	$ -	$ -	$ 1,946
TECH3 PO M	INTT Construction	Ladder Layer 0		$ -	$ -	$ 6,164	$ 324	$ -	$ 6,488
		Ladder Layer 1,2 , 3		$ -	$ -	$ 5,839	$ -	$ -	$ 5,839
		Barrel Assembly 0,1,2,3		$ -	$ -	$ -	$ 7,786	$ -	$ 7,786
TECH3 PO M Total				$ -	$ -	$ 12,003	$ 8,110	$ -	$ 20,113
TECH3 PO D	INTT Construction	Ladder Layer 0		$ -	$ -	$ 3,244	$ 6,488	$ -	$ 9,732
		Ladder Layer 1,2 , 3		$ -	$ -	$ 3,244	$ 6,488	$ -	$ 9,732
		Stave Layer 0		$ -	$ -	$ 6,488	$ -	$ -	$ 6,488
		Stave Layer 1,2,3		$ -	$ -	$ 6,488	$ -	$ -	$ 6,488
		Barrel Mount		$ -	$ -	$ 9,732	$ -	$ -	$ 9,732
		INTT Space Frame		$ -	$ -	$ 9,732	$ -	$ -	$ 9,732
		INTT Assembly		$ -	$ -	$ 3,893	$ 2,595	$ -	$ 6,488
TECH3 PO D Total				$ -	$ -	$ 42,821	$ 15,571	$ -	$ 58,392
CRAFT3	INTT Construction	Ladder Layer 0		$ -	$ -	$ -	$ 1,816	$ -	$ 1,816
		Ladder Layer 1,2 , 3		$ -	$ -	$ -	$ 1,816	$ -	$ 1,816
		INTT Assembly		$ -	$ -	$ -	$ 5,448	$ -	$ 5,448
CRAFT3 Total				$ -	$ -	$ -	$ 9,079	$ -	$ 9,079
Grand Total				$ 80,000	$ 1,136,064	$ 130,707	$ -	$ -	$ 1,346,770
				$ -	$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -	$ -
		Converted to US Dollar for Direct Material Cost Estimates		$ 80,000	$ 1,081,240	$ 96,000	$ -	$ -	$ 1,257,240
		Converted to US Dollar for Direct Labor Cost Estimates		$ -	$ 54,824	$ 34,707	$ -	$ -	$ 89,530
		INTT Total Direct Costs (Dollar)		$ 80,000	$ 1,136,064	$ 130,707	$ -	$ -	$ 1,346,770

Summary Obtained from the WBS

Cost for each year: fixed cost, labor cost, procurements…in YEN

INTT Project Estimate - March 13, 2017 rev 1 (031517)

Description				Japanese Fiscal Year (APR- Mar)					
Resources	Task 3	Task 4	Task 5	2016	2017	2018	2019	2020	Grand Total
Task's Fixed Cost	INTT Construction	Ladder Layer 0				¥ 3,300,000			¥ 3,300,000
		Ladder Layer 1,2 , 3				¥ 6,300,000			¥ 6,300,000
		Stave Layer 0			¥ 680,000				¥ 680,000
		Stave Layer 1,2,3			¥ 2,500,000	¥ -			¥ 2,500,000
		Barrel Mount			¥ 1,200,000				¥ 1,200,000
		INTT Space Frame			¥ 1,000,000	¥ -			¥ 1,000,000
	INTT Construction Total				¥ 5,380,000	¥ 9,600,000			¥ 14,980,000
	INTT Electronics	Silicon Sensor layer 0			¥ 11,300,000				¥ 11,300,000
		Silicon Sensor layer 1,2, 3	Procurement Prototype 1	¥ 5,000,000					¥ 5,000,000
			Procurement Prototype 2 (PreProduction)		¥ 5,000,000				¥ 5,000,000
			Procurement for Production		¥ 31,500,000				¥ 31,500,000
		Silicon Sensor layer 1,2, 3 Total		¥ 5,000,000	¥ 36,500,000				¥ 41,500,000
		FPHX Chips			¥ 8,360,000				¥ 8,360,000
		HDI		¥ 3,000,000	¥ 46,584,000				¥ 49,584,000
	INTT Electronics Total			¥ 8,000,000	¥ 102,744,000				¥ 110,744,000
Task's Fixed Cost Total				¥ 8,000,000	¥ 108,124,000	¥ 9,600,000			¥ 125,724,000
TECH3 PO E	INTT Construction	INTT Assembly				¥ 194,640	¥ -	¥ -	¥ 194,640
	INTT Construction Total					¥ 194,640	¥ -	¥ -	¥ 194,640
TECH3 PO E Total						¥ 194,640	¥ -	¥ -	¥ 194,640
TECH3 PO M	INTT Construction	Ladder Layer 0			¥ 616,360	¥ 32,440	¥ -	¥ -	¥ 648,800
		Ladder Layer 1,2 , 3			¥ 583,920	¥ -	¥ -	¥ -	¥ 583,920
		Barrel Assembly 0,1,2,3				¥ 778,560	¥ -	¥ -	¥ 778,560
TECH3 PO M Total					¥ 1,200,280	¥ 811,000	¥ -	¥ -	¥ 2,011,280
TECH3 PO D	INTT Construction	Ladder Layer 0			¥ 324,400	¥ 648,800	¥ -	¥ -	¥ 973,200
		Ladder Layer 1,2 , 3			¥ 324,400	¥ 648,800	¥ -	¥ -	¥ 973,200
		Stave Layer 0			¥ 648,800	¥ -	¥ -	¥ -	¥ 648,800
		Stave Layer 1,2,3			¥ 648,800	¥ -	¥ -	¥ -	¥ 648,800
		Barrel Mount			¥ 973,200	¥ -	¥ -	¥ -	¥ 973,200
		INTT Space Frame			¥ 973,200	¥ -	¥ -	¥ -	¥ 973,200
		INTT Assembly			¥ 389,280	¥ 259,520	¥ -	¥ -	¥ 648,800
	INTT_sPHENIX_2017_02_28 Total								
TECH3 PO D Total					¥ 4,282,080	¥ 1,557,120	¥ -	¥ -	¥ 5,839,200
CRAFT3	INTT Construction	Ladder Layer 0				¥ 181,584	¥ -	¥ -	¥ 181,584
		Ladder Layer 1,2 , 3				¥ 181,584	¥ -	¥ -	¥ 181,584
		INTT Assembly				¥ 544,752	¥ -	¥ -	¥ 544,752
CRAFT3 Total						¥ 907,920	¥ -	¥ -	¥ 907,920
Grand Total				¥ 8,000,000	¥ 113,606,360	¥ 13,070,680	¥ -	¥ -	¥ 134,677,040

JFD 17 Fixed Yen for Direct Material Cost Estimates	¥ 8,000,000	¥ 108,124,000	¥ 9,600,000	¥ -	¥ -	¥ 125,724,000
JFD 17 Fixed Yen for Direct Labor Cost Estimates	¥ -	¥ 5,482,360	¥ 3,470,680	¥ -	¥ -	¥ 8,953,040
INTT Total Direct Costs (Yen)	¥ 8,000,000	¥ 113,606,360	¥ 13,070,680	¥ -	¥ -	¥ 134,677,040

Estimated based on dollar to yen exchange 1: 100

Estimate based on fixed FY 17 yen and does not include overheads

INTT WBS

Much Simplify format for the costs obtained from the WBS file

Task Name	Fixed Cost	Cost	fixed cost with conversion	Net Labor
Design Prototype 1	¥0	¥0	¥0	¥0
Procurement Prototype 1	¥5,000,000	¥5,000,000	¥5,000,000	¥0
Fabrication Prototype 1	¥0	¥0	¥0	¥0
Design Prototype 2 (PreProduction)	¥0	¥0	¥0	¥0
Procurement Prototype 2 (PreProduction)	¥5,000,000	¥5,000,000	¥5,000,000	¥0
Fabrication Prototype 2 (PreProduction)	¥0	¥0	¥0	¥0
Procurement for Production	¥31,500,001	¥31,500,001	¥31,500,001	(¥2)
Production	¥0	¥0	¥0	¥0
FPHX Chips	**¥0**	**¥8,360,000**	**¥8,360,000**	**¥0**
Procurement	¥4,360,000	¥4,360,000	¥4,360,000	¥0
Production	¥0	¥0	¥0	¥0
Procurement	¥1,000,000	¥1,000,000	¥1,000,000	¥0
Dicing	¥0	¥0	¥0	¥0
Procurement	¥3,000,000	¥3,000,000	¥3,000,000	¥0
Testing	¥0	¥0	¥0	¥0
HDI	**¥0**	**¥49,583,994**	**¥49,584,005**	**¥0**
HDI Layer 0	**¥0**	**¥8,800,000**	**¥8,800,000**	**¥0**
Design Prototype 1	¥0	¥0	¥0	¥0
Procurement Porotype 1	¥3,000,000	¥3,000,000	¥3,000,000	¥0
Fabrication Prototype 1	¥0	¥0	¥0	¥0
Design Production	¥0	¥0	¥0	¥0
Procurement Production	¥5,800,000	¥5,800,000	¥5,800,000	¥0
Fabrication Production	¥0	¥0	¥0	¥0
HDI Layer 1,2,3	**¥0**	**¥35,200,000**	**¥35,200,000**	**¥0**
Design Prototype 1	¥0	¥0	¥0	¥0
Procurement Prototype 1	¥3,000,000	¥3,000,000	¥3,000,000	¥0
Fabrication Prototype 1	¥0	¥0	¥0	¥0
Design Prototype 2 (PreProduction)	¥0	¥0	¥0	¥0
Procurement of Prototype 2	¥3,000,000	¥3,000,000	¥3,000,000	¥0
Fabrication Prototype 2 (PreProduction)	¥0	¥0	¥0	¥0
Procurement for Production	¥29,200,000	¥29,200,000	¥29,200,000	¥0
Production	¥0	¥0	¥0	¥0
Extension Cable Layer 0	**¥0**	**¥1,064,000**	**¥1,064,000**	**¥0**
Design Prototype 1	¥0	¥0	¥0	¥0
Procurement Prototype 1	¥200,000	¥200,000	¥200,000	¥0
Fabrication Prototype 1	¥0	¥0	¥0	¥0
Testing Prototype 1	¥0	¥0	¥0	¥0
Extension Cable test Setup	¥0	¥0	¥0	¥0
Procurement for Production	¥864,000	¥864,000	¥864,000	¥0
Production	¥0	¥0	¥0	¥0

Summary

- The WBS file is an excellent way to track the progress of the INTT project: we will continue to improve the INTT WBS until the end of the project in September 2020.

- INTT group concern:
  - BNL engineers and technicians costs in INTT project

    (we need to discuss it offline because it required more time than 10 minutes).

Auxiliaries Slides

Auxiliaries Slide: Page 1

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1		**1**	**sPHENIX**	**995 days?**	**Tue 1/3/17**	**Wed 12/30/20**		
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4		**1.12.1.1**	**Ladder Layer 0**	**325 days**	**Thu 8/31/17**	**Thu 12/20/18**		
5		1.12.1.1.1	Design Prototype 1 Module Support	5 days	Thu 8/31/17	Thu 9/7/17		6
6		1.12.1.1.2	Fabrication Porotype 1 Module Support	5 days	Fri 9/8/17	Thu 9/14/17	5	7
7		1.12.1.1.3	Silicon Module Prototype 1	20 days	Fri 9/15/17	Thu 10/12/17	6	8
8		1.12.1.1.4	Silicon Module Prototype 1 Testing	10 days	Fri 10/13/17	Thu 10/26/17	7	
9		1.12.1.1.5	Silicon Module Assembly Prototype 2 (PreProduction)	20 days	Wed 3/7/18	Tue 4/3/18		10
10		1.12.1.1.6	Silicon Module Prototype 2 Testing	10 days	Wed 4/4/18	Tue 4/17/18	9	11
11		1.12.1.1.7	Design Ladder Assembly Fixtures	10 days	Wed 4/18/18	Tue 5/1/18	10	12
12		1.12.1.1.8	Fabrication Assembly Fixtures	20 days	Wed 5/2/18	Wed 5/30/18	11	13
13		1.12.1.1.9	Ladder Prototype Assembly	20 days	Thu 5/31/18	Wed 6/27/18	12	14
14		1.12.1.1.10	Ladder Prototype Testing	20 days	Thu 6/28/18	Fri 7/27/18	13	15
15		1.12.1.1.11	Ladder Production	100 days	Mon 7/30/18	Thu 12/20/18	14	
16		**1.12.1.2**	**Ladder Layer 1,2 , 3**	**401 days**	**Mon 5/15/17**	**Fri 12/21/18**		
17		1.12.1.2.1	Design Prototype 1 Module Support	5 days	Mon 5/15/17	Fri 5/19/17		18
18		1.12.1.2.2	Fabrication Porotype 1 Module Support	5 days	Mon 5/22/17	Fri 5/26/17	17	19
19		1.12.1.2.3	Silicon Module Prototype 1	20 days	Tue 5/30/17	Mon 6/26/17	18	20
20		1.12.1.2.4	Silicon Module Prototype 1 Testing	10 days	Tue 6/27/17	Wed 7/12/17	19	
21		1.12.1.2.5	Silicon Module Assembly Prototype 2 (PreProduction)	20 days	Tue 11/21/17	Wed 12/20/17		22
22		1.12.1.2.6	Silicon Module Prototype 2 Testing	17 days	Thu 12/21/17	Thu 1/18/18	21	

Auxiliaries Slide: Page 2

ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
23		1.12.1.2.7	Design Ladder Assembly Fixtures	10 days	Thu 4/19/18	Wed 5/2/18		24
24		1.12.1.2.8	Fabrication Ladder Assembly Fixtures	20 days	Thu 5/3/18	Thu 5/31/18	23	25
25		1.12.1.2.9	Ladder Assembly Prototype	20 days	Fri 6/1/18	Thu 6/28/18	24	26
26		1.12.1.2.10	Ladder Prototype Testing	20 days	Fri 6/29/18	Mon 7/30/18	25	27
27		1.12.1.2.11	Ladder Production	100 days	Tue 7/31/18	Fri 12/21/18	26	
28		**1.12.1.3**	**Stave Layer 0**	**261 days**	**Thu 6/1/17**	**Mon 6/18/18**		
29		1.12.1.3.1	Conceptual Design of the Stave	30 days	Thu 6/1/17	Fri 7/14/17		30
30		1.12.1.3.2	Thermal Mechanical Simulation	20 days	Mon 7/17/17	Fri 8/11/17	29	31
31		1.12.1.3.3	Design Stave Prototype 1	10 days	Tue 8/29/17	Tue 9/12/17	30	32
32		1.12.1.3.4	Procurement for Stave Prototype 1	40 days	Wed 9/13/17	Tue 11/7/17	31	33
33		1.12.1.3.5	Fabrication Stave Prototype 1	30 days	Wed 11/8/17	Tue 12/26/17	32	34
34		1.12.1.3.6	Testing of Stave Prototype 1	20 days	Wed 12/27/17	Thu 1/25/18	33	35
35		1.12.1.3.7	Procurement for Stave Production	40 days	Fri 1/26/18	Fri 3/23/18	34	36
36		1.12.1.3.8	Stave Production	60 days	Mon 3/26/18	Mon 6/18/18	35	
37		**1.12.1.4**	**Stave Layer 1,2,3**	**250 days**	**Wed 7/5/17**	**Tue 7/3/18**		
38		1.12.1.4.1	Conceptual Design of the Stave	30 days	Wed 7/5/17	Tue 8/15/17		39
39		1.12.1.4.2	Thermal Mechanical Simulation	20 days	Wed 8/16/17	Wed 9/13/17	38	40
40		1.12.1.4.3	Design Stave Prototype 1	10 days	Thu 9/14/17	Wed 9/27/17	39	41
41		1.12.1.4.4	Procurement for Stave Prototype 1	40 days	Thu 9/28/17	Thu 11/23/17	40	42
42		1.12.1.4.5	Fabrication Stave Prototype 1	30 days	Fri 11/24/17	Thu 1/11/18	41	43
43		1.12.1.4.6	Testing of Stave Prototype 1	20 days	Fri 1/12/18	Fri 2/9/18	42	44
44		1.12.1.4.7	Procurement for Stave Production	40 days	Mon 2/12/18	Mon 4/9/18	43	45
45		1.12.1.4.8	Stave Production	60 days	Tue 4/10/18	Tue 7/3/18	44	
46		**1.12.1.5**	**Barrel Mount**	**115 days**	**Fri 1/5/18**	**Tue 6/19/18**		

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ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
47		1.12.1.5.1	Design of Barrels Mounts 0, 1, 2, 3	15 days	Fri 1/5/18	Fri 1/26/18		48
48		1.12.1.5.2	Procurement of Barrels Mounts	40 days	Mon 1/29/18	Mon 3/26/18	47	49
49		1.12.1.5.3	Fabrication of Barrels Mounts	60 days	Tue 3/27/18	Tue 6/19/18	48	
50		**1.12.1.6**	**Barrel Assembly 0,1,2,3**	**60 days**	**Mon 7/2/18**	**Wed 9/26/18**		
51		1.12.1.6.1	Barrel 0 Assembly	5 days	Mon 7/2/18	Tue 7/10/18		52
52		1.12.1.6.2	Barrel 0 Testing	5 days	Wed 7/11/18	Tue 7/17/18	51	53
53		1.12.1.6.3	Barrel 0 Survey	5 days	Wed 7/18/18	Tue 7/24/18	52	54
54		1.12.1.6.4	Barrel 1 Assembly	5 days	Wed 7/25/18	Tue 7/31/18	53	55
55		1.12.1.6.5	Barrel 1 Testing	5 days	Wed 8/1/18	Tue 8/7/18	54	56
56		1.12.1.6.6	Barrel 1 Survey	5 days	Wed 8/8/18	Tue 8/14/18	55	57
57		1.12.1.6.7	Barrel 2 Assembly	5 days	Wed 8/15/18	Tue 8/21/18	56	58
58		1.12.1.6.8	Barrel 2 Testing	5 days	Wed 8/22/18	Tue 8/28/18	57	59
59		1.12.1.6.9	Barrel 2 Survey	5 days	Wed 8/29/18	Wed 9/5/18	58	60
60		1.12.1.6.10	Barrel 3 Assembly	5 days	Thu 9/6/18	Wed 9/12/18	59	61
61		1.12.1.6.11	Barrel 3 Testing	5 days	Thu 9/13/18	Wed 9/19/18	60	62
62		1.12.1.6.12	Barrel 3 Survey	5 days	Thu 9/20/18	Wed 9/26/18	61	
63		**1.12.1.7**	**INTT Space Frame**	**135 days**	**Thu 2/1/18**	**Tue 8/14/18**		
64		1.12.1.7.1	Mechanical Simulation	20 days	Thu 2/1/18	Thu 3/1/18		
65		1.12.1.7.2	Design of Space Frame	15 days	Fri 3/2/18	Thu 3/22/18		66
66		1.12.1.7.3	Procurement	40 days	Fri 3/23/18	Thu 5/17/18	65	67
67		1.12.1.7.4	Production	60 days	Fri 5/18/18	Tue 8/14/18	66	
68		**1.12.1.8**	**INTT Assembly**	**155 days**	**Fri 3/23/18**	**Wed 10/31/18**		
69		1.12.1.8.1	Design Assembly Fixtures	10 days	Fri 3/23/18	Thu 4/5/18		70
70		1.12.1.8.2	Fabrication Assembly Fixtures	6 days	Fri 4/6/18	Fri 4/13/18	69	

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ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
71		1.12.1.8.3	Assembly	5 days	Thu 9/27/18	Wed 10/3/18		72
72		1.12.1.8.4	Testing	10 days	Thu 10/4/18	Wed 10/17/18	71	73
73		1.12.1.8.5	INTT Survey	10 days	Thu 10/18/18	Wed 10/31/18	72	
74		**1.12.2**	**INTT Electronics**	**767 days**	**Tue 1/3/17**	**Fri 1/31/20**		
75		**1.12.2.1**	**Silicon Sensor layer 0**	**254 days**	**Wed 3/1/17**	**Wed 3/7/18**		
76		1.12.2.1.1	Design Prototype 1	43 days	Wed 3/1/17	Fri 4/28/17		77
77		1.12.2.1.2	Procurement Prototype1	20 days	Mon 5/1/17	Fri 5/26/17	76	78
78		1.12.2.1.3	Fabrication Prototype 1	60 days	Tue 5/30/17	Wed 8/23/17	77	
79		1.12.2.1.4	Design Production	10 days	Mon 9/11/17	Fri 9/22/17		
80		1.12.2.1.5	Procurement Production	40 days	Tue 10/10/17	Thu 12/7/17		81
81		1.12.2.1.6	Fabrication Production	59 days	Fri 12/8/17	Wed 3/7/18	80	
82		**1.12.2.2**	**Silicon Sensor layer 1,2, 3**	**325 days**	**Tue 1/3/17**	**Fri 4/20/18**		
83		1.12.2.2.1	Design Prototype 1	30 days	Tue 1/3/17	Tue 2/14/17		
84		1.12.2.2.2	Procurement Prototype 1	20 days	Wed 1/18/17	Tue 2/14/17		85
85		1.12.2.2.3	Fabrication Prototype 1	30 days	Wed 2/15/17	Wed 3/29/17	84	
86		1.12.2.2.4	Design Prototype 2 (PreProduction)	20 days	Tue 6/6/17	Wed 7/5/17		87
87		1.12.2.2.5	Procurement Prototype 2 (PreProduction)	39 days	Thu 7/6/17	Tue 8/29/17	86	88
88		1.12.2.2.6	Fabrication Prototype 2 (PreProduction)	59 days	Wed 8/30/17	Wed 11/22/17	87	89
89		1.12.2.2.7	Procurement for Production	40 days	Thu 11/23/17	Thu 1/25/18	88	90
90		1.12.2.2.8	Production	60 days	Fri 1/26/18	Fri 4/20/18	89	
91		**1.12.2.3**	**FPHX Chips**	**263 days**	**Mon 4/3/17**	**Fri 4/20/18**		
92		1.12.2.3.1	Procurement	20 days	Mon 4/3/17	Fri 4/28/17		
93		1.12.2.3.2	Production	60 days	Tue 5/30/17	Wed 8/23/17		

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ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
94		1.12.2.3.3	Procurement	20 days	Tue 8/29/17	Tue 9/26/17		95
95		1.12.2.3.4	Dicing	60 days	Wed 9/27/17	Tue 12/26/17	94	96
96		1.12.2.3.5	Procurement	20 days	Wed 12/27/17	Thu 1/25/18	95	97
97		1.12.2.3.6	Testing	60 days	Fri 1/26/18	Fri 4/20/18	96	
98		**1.12.2.4**	**HDI**	**767 days**	**Tue 1/3/17**	**Fri 1/31/20**		
99		**1.12.2.4.1**	**HDI Layer 0**	**728 days**	**Wed 3/1/17**	**Fri 1/31/20**		
100		1.12.2.4.1.1	Design Prototype 1	65 days	Wed 3/1/17	Wed 5/31/17		
101		1.12.2.4.1.2	Procurement Porotype 1	21 days	Mon 5/1/17	Tue 5/30/17		102
102		1.12.2.4.1.3	Fabrication Prototype 1	335 days	Wed 5/31/17	Fri 1/31/20	101	
103		1.12.2.4.1.4	Design Production	20 days	Wed 10/11/17	Tue 11/7/17		104
104		1.12.2.4.1.5	Procurement Production	40 days	Wed 11/8/17	Wed 1/10/18	103	105
105		1.12.2.4.1.6	Fabrication Production	40 days	Thu 1/11/18	Fri 3/9/18	104	
106		**1.12.2.4.2**	**HDI Layer 1,2,3**	**305 days**	**Tue 1/3/17**	**Fri 3/23/18**		
107		1.12.2.4.2.1	Design Prototype 1	30 days	Tue 1/3/17	Tue 2/14/17		
108		1.12.2.4.2.2	Procurement Prototype 1	20 days	Tue 1/17/17	Mon 2/13/17		109
109		1.12.2.4.2.3	Fabrication Prototype 1	64 days	Tue 2/14/17	Mon 5/15/17	108	
110		1.12.2.4.2.4	Design Prototype 2 (PreProduction)	20 days	Wed 7/5/17	Tue 8/1/17		111
111		1.12.2.4.2.5	Procurement of Prototype 2	39 days	Wed 8/2/17	Tue 9/26/17	110	112
112		1.12.2.4.2.6	Fabrication Prototype 2 (PreProduction)	40 days	Wed 9/27/17	Wed 11/22/17	111	113
113		1.12.2.4.2.7	Procurement for Production	40 days	Thu 11/23/17	Thu 1/25/18	112	114
114		1.12.2.4.2.8	Production	40 days	Fri 1/26/18	Fri 3/23/18	113	
115		**1.12.2.4.3**	**Extension Cable Layer 0**	**191 days**	**Wed 3/1/17**	**Wed 11/29/17**		
116		1.12.2.4.3.1	Design Prototype 1	40 days	Wed 3/1/17	Tue 4/25/17		117
117		1.12.2.4.3.2	Procurement Prototype 1	2 days	Wed 4/26/17	Thu 4/27/17	116	

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ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
118		1.12.2.4.3.3	Fabrication Prototype 1	45 days	Fri 4/28/17	Fri 6/30/17		119
119		1.12.2.4.3.4	Testing Prototype 1	10 days	Wed 7/5/17	Tue 7/18/17	118	120
120		1.12.2.4.3.5	Extension Cable test Setup	10 days	Wed 7/19/17	Tue 8/1/17	119	
121		1.12.2.4.3.6	Procurement for Production	40 days	Tue 7/18/17	Tue 9/12/17		122
122		1.12.2.4.3.7	Production	40 days	Wed 9/13/17	Tue 11/7/17	121	123
123		1.12.2.4.3.8	Cables Testing	15 days	Wed 11/8/17	Wed 11/29/17	122	
124		**1.12.2.4.4**	**Extension Cable Layer 1,2,3**	**190 days**	**Wed 3/1/17**	**Tue 11/28/17**		
125		1.12.2.4.4.1	Design Prototype 1	39 days	Wed 3/1/17	Mon 4/24/17		126
126		1.12.2.4.4.2	Procurement Porotype 1	3 days	Tue 4/25/17	Thu 4/27/17	125	127
127		1.12.2.4.4.3	Fabrication Prototype 1	44 days	Fri 4/28/17	Thu 6/29/17	126	128
128		1.12.2.4.4.4	Testing Prototype 1	10 days	Fri 6/30/17	Mon 7/17/17	127	129
129		1.12.2.4.4.5	Extension Cable test Setup	10 days	Tue 7/18/17	Mon 7/31/17	128	
130		1.12.2.4.4.6	Procurement for Production	40 days	Mon 7/17/17	Mon 9/11/17		131
131		1.12.2.4.4.7	Production	40 days	Tue 9/12/17	Mon 11/6/17	130	132
132		1.12.2.4.4.8	Cables Testing	15 days	Tue 11/7/17	Tue 11/28/17	131	
133		**1.12.2.4.5**	**ROC FVTX**	**50 days**	**Fri 9/15/17**	**Fri 11/24/17**		
134		1.12.2.4.5.1	ROC Status	20 days	Fri 9/15/17	Thu 10/12/17		135
135		1.12.2.4.5.2	ROC Testing	30 days	Fri 10/13/17	Fri 11/24/17	134	
136		**1.12.2.4.6**	**FEM FVTX at 1008**	**50 days**	**Wed 11/29/17**	**Wed 2/14/18**		
137		1.12.2.4.6.1	FEM Status	20 days	Wed 11/29/17	Tue 1/2/18		138
138		1.12.2.4.6.2	FEM Testing	30 days	Wed 1/3/18	Wed 2/14/18	137	
139		**1.12.3**	**INTT offline Software**	**995 days**	**Tue 1/3/17**	**Wed 12/30/20**		
140		**1.12.3.1**	**INTT GEANT Model**	**160 days**	**Tue 1/3/17**	**Mon 8/21/17**		

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ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
141		1.12.3.1.1	Silicon Sensor Implementation in GEANT/sPHE	40 days	Tue 1/3/17	Wed 3/1/17		142
142		1.12.3.1.2	HDI Implementation in GEANT/sPHENIX	40 days	Thu 3/2/17	Wed 4/26/17	141	143
143		1.12.3.1.3	Extender Cable implementation in GEANT/sPH	40 days	Thu 4/27/17	Thu 6/22/17	142	144
144		1.12.3.1.4	Stave Implementation in GEANT/sPHENIX	40 days	Fri 6/23/17	Mon 8/21/17	143	
145		**1.12.3.2**	**Simulation**	**225 days**	**Tue 2/14/17**	**Tue 1/9/18**		
146		1.12.3.2.9	Implementation of z-sensitive Layer	54 days	Tue 2/14/17	Mon 5/1/17		147
147		1.12.3.2.1	Performance Evaluation	170 days	Wed 5/3/17	Tue 1/9/18	146	
148		**1.12.3.3**	**Development of Analysis Code**	**248 days**	**Fri 1/3/20**	**Wed 12/30/20**		
149		1.12.3.3.1	Tracking, DCA Separation	248 days	Fri 1/3/20	Wed 12/30/20		
150		**1.12.4**	**INTT Integration in sPHENIX**	**221 days**	**Mon 1/8/18**	**Wed 11/21/18**		
151		**1.12.4.1**	**Detector Monitoring**	**100 days**	**Mon 1/8/18**	**Wed 5/30/18**		
152		1.12.4.1.1	Temperature Monitoring	50 days	Mon 1/8/18	Tue 3/20/18		153
153		1.12.4.1.2	Humidity Monitoring	50 days	Wed 3/21/18	Wed 5/30/18	152	
154		**1.12.4.2**	**DAQ Service at 1008**	**50 days**	**Mon 1/8/18**	**Tue 3/20/18**		
155		1.12.4.2.1	DCM Status	20 days	Mon 1/8/18	Mon 2/5/18		156
156		1.12.4.2.5	DCM Testing	30 days	Tue 2/6/18	Tue 3/20/18	155	
157		**1.12.4.3**	**Data Monitoring**	**120 days**	**Fri 6/1/18**	**Wed 11/21/18**		
158		1.12.4.3.1	Online Monitoring	120 days	Fri 6/1/18	Wed 11/21/18		
159		**1.12.5**	**INTT Auxiliary Systems and Integration (BNL Responsibility)**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
160		**1.12.5.1**	**INTT Mechanical Service**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
161		1.12.5.1.1	ROC mechanical support	1 day?	Tue 1/3/17	Tue 1/3/17		
162		1.12.5.1.2	INTT Mechanical Support	1 day?	Tue 1/3/17	Tue 1/3/17		

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ID	Task Mode	WBS	Task Name	Duration	Start	Finish	Pre	Successors
163		**1.12.5.2**	**Cooling System**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
164		1.12.5.2.1	Design	1 day?	Tue 1/3/17	Tue 1/3/17		
165		1.12.5.2.2	Mock up Testing	1 day?	Tue 1/3/17	Tue 1/3/17		
166		1.12.5.2.3	Final Design of Cooling System	1 day?	Tue 1/3/17	Tue 1/3/17		
167		**1.12.5.3**	**ROC Cooling System**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
168		1.12.5.3.1	Design Support/Cooling	1 day?	Tue 1/3/17	Tue 1/3/17		
169		1.12.5.3.2	Fabrication Support/Cooling	1 day?	Tue 1/3/17	Tue 1/3/17		
170		**1.12.5.4**	**Safety System**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
171		1.12.5.4.1	Review Sensors and Interlocks	1 day?	Tue 1/3/17	Tue 1/3/17		
172		1.12.5.4.2	Electrical Interlock Design	1 day?	Tue 1/3/17	Tue 1/3/17		
173		1.12.5.4.3	Cooling Interlocks Design	1 day?	Tue 1/3/17	Tue 1/3/17		
174		**1.12.5.5**	**INTT Electronic Services**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
175		1.12.5.5.1	Extension Cable Trays	1 day?	Tue 1/3/17	Tue 1/3/17		
176		1.12.5.5.2	Fibers + Power Cables + Patch Panel	1 day?	Tue 1/3/17	Tue 1/3/17		
177		1.12.5.5.14	Racks	1 day?	Tue 1/3/17	Tue 1/3/17		
178		1.12.5.5.15	Low Voltage Supplies	1 day?	Tue 1/3/17	Tue 1/3/17		
179		1.12.5.5.16	Bias Voltage Supplies	1 day?	Tue 1/3/17	Tue 1/3/17		
180		1.12.5.5.17	Slow Control Infrastructure	1 day?	Tue 1/3/17	Tue 1/3/17		
181		**1.12.5.6**	**Slow Control System**	**1 day?**	**Tue 1/3/17**	**Tue 1/3/17**		
182		1.12.5.6.1	Low Voltage System	1 day?	Tue 1/3/17	Tue 1/3/17		
183		1.12.5.6.2	High Voltage System	1 day?	Tue 1/3/17	Tue 1/3/17		

Summary Obtained from the WBS

Cost for each year: fixed cost, labor cost, procurements…in Dollars

INTT Project Estimate - March 13, 2017 rev 1 (031517)

Description				Japanese Fiscal Year (APR- Mar)					
Resources	Task 3	Task 4	Task 5	2016	2017	2018	2019	2020	Grand Total
Task's Fixed Cost	INTT Construction	Ladder Layer 0		$ -	$ -	$ 33,000	$ -	$ -	$ 33,000
		Ladder Layer 1,2 , 3		$ -	$ -	$ 63,000	$ -	$ -	$ 63,000
		Stave Layer 0		$ -	$ 6,800	$ -	$ -	$ -	$ 6,800
		Stave Layer 1,2,3		$ -	$ 25,000	$ -	$ -	$ -	$ 25,000
		Barrel Mount		$ -	$ 12,000	$ -	$ -	$ -	$ 12,000
		INTT Space Frame		$ -	$ 10,000	$ -	$ -	$ -	$ 10,000
	INTT Construction Total			$ -	$ 53,800	$ 96,000	$ -	$ -	$ 149,800
	INTT Electronics	Silicon Sensor layer 0		$ -	$ 113,000	$ -	$ -	$ -	$ 113,000
		Silicon Sensor layer 1,2, 3	Procurement Prototype 1	$ 50,000	$ -	$ -	$ -	$ -	$ 50,000
			Procurement Prototype 2 (PreProduction)	$ -	$ 50,000	$ -	$ -	$ -	$ 50,000
			Procurement for Production	$ -	$ 315,000	$ -	$ -	$ -	$ 315,000
		Silicon Sensor layer 1,2, 3 Total		$ 50,000	$ 365,000	$ -	$ -	$ -	$ 415,000
		FPHX Chips		$ -	$ 83,600	$ -	$ -	$ -	$ 83,600
		HDI		$ 30,000	$ 465,840	$ -	$ -	$ -	$ 495,840
	INTT Electronics Total			$ 80,000	$ 1,027,440	$ -	$ -	$ -	$ 1,107,440
Task's Fixed Cost Total				$ 80,000	$ 1,081,240	$ 96,000	$ -	$ -	$ 1,257,240
TECH3 PO E	INTT Construction	INTT Assembly		$ -	$ -	$ 1,946	$ -	$ -	$ 1,946
	INTT Construction Total			$ -	$ -	$ 1,946	$ -	$ -	$ 1,946
TECH3 PO E Total				$ -	$ -	$ 1,946	$ -	$ -	$ 1,946
TECH3 PO M	INTT Construction	Ladder Layer 0		$ -	$ 6,164	$ 324	$ -	$ -	$ 6,488
		Ladder Layer 1,2 , 3		$ -	$ 5,839	$ -	$ -	$ -	$ 5,839
		Barrel Assembly 0,1,2,3		$ -	$ -	$ 7,786	$ -	$ -	$ 7,786
TECH3 PO M Total				$ -	$ 12,003	$ 8,110	$ -	$ -	$ 20,113
TECH3 PO D	INTT Construction	Ladder Layer 0		$ -	$ 3,244	$ 6,488	$ -	$ -	$ 9,732
		Ladder Layer 1,2 , 3		$ -	$ 3,244	$ 6,488	$ -	$ -	$ 9,732
		Stave Layer 0		$ -	$ 6,488	$ -	$ -	$ -	$ 6,488
		Stave Layer 1,2,3		$ -	$ 6,488	$ -	$ -	$ -	$ 6,488
		Barrel Mount		$ -	$ 9,732	$ -	$ -	$ -	$ 9,732
		INTT Space Frame		$ -	$ 9,732	$ -	$ -	$ -	$ 9,732
		INTT Assembly		$ -	$ 3,893	$ 2,595	$ -	$ -	$ 6,488
TECH3 PO D Total				$ -	$ 42,821	$ 15,571	$ -	$ -	$ 58,392
CRAFT3	INTT Construction	Ladder Layer 0		$ -	$ -	$ 1,816	$ -	$ -	$ 1,816
		Ladder Layer 1,2 , 3		$ -	$ -	$ 1,816	$ -	$ -	$ 1,816
		INTT Assembly		$ -	$ -	$ 5,448	$ -	$ -	$ 5,448
CRAFT3 Total				$ -	$ -	$ 9,079	$ -	$ -	$ 9,079
Grand Total				$ 80,000	$ 1,136,064	$ 130,707	$ -	$ -	$ 1,346,770
				$ -	$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -	$ -
		Converted to US Dollar for Direct Material Cost Estimates		$ 80,000	$ 1,081,240	$ 96,000	$ -	$ -	$ 1,257,240
		Converted to US Dollar for Direct Labor Cost Estimates		$ -	$ 54,824	$ 34,707	$ -	$ -	$ 89,530
		INTT Total Direct Costs (Dollar)		$ 80,000	$ 1,136,064	$ 130,707	$ -	$ -	$ 1,346,770